

Improvements to the regulatory framework for asset health and operational resilience

Annex 2: Review of UK regulatory precedent

5 July 2024

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Introduction

In January 2024, four water companies – Affinity Water, Anglian Water, Northumbrian Water and Wessex Water – started a programme of work to consider potential reforms to the regulatory framework for water companies, in relation to the treatment of capital maintenance and asset health. This is intended to support the development of the approach to the PR29 price review. The motivation for the project is a growing concern that the current regulatory approach to funding capital maintenance expenditure (e.g. asset replacement) – and the wider regulatory arrangements relating to asset health – are not fit for purpose.

The initial phase of the work programme is built around two workstreams commissioned from the consultancies Reckon and Jacobs:

- **Workstream 1:** this workstream, carried out by Jacobs, has identified and assessed a range of metrics that would help to reveal current and future asset health risks and historical trends in asset health, including metrics that could support the potential changes to the regulatory approach identified in workstream 2.
- **Workstream 2:** this workstream, carried out by Reckon, has concerned potential problems with Ofwat’s current regulatory framework, in relation to the treatment of capital maintenance expenditure, asset health and risks to customer service and environmental outcomes in the future. It has explored potential reforms to the regulatory approach to tackle these problems.

This document is an annex to Reckon’s main report from workstream 2. As part of workstream 2 we have reviewed the regulatory approach relating to capital maintenance in six UK regulated sectors / jurisdictions, beyond the water industry in England and Wales (see table below). The main purpose of this exercise was to feed into a structured long list of potential options for changes to Ofwat’s regulatory framework that could help tackle some of the concerns identified with that framework in relation to capital maintenance and asset health. This document summarises key points from our review.

The table below sets out the regulated sectors / jurisdictions covered in our review.

Table 1 **Scope of review**

Regulator	Companies (and price review)
Ofgem	Electricity and gas transmission and distribution companies (RIIO-2)
WICS	Scottish Water (SRC2021–2027)
Utility Regulator	NI Water (PR21)
Utility Regulator	NIE Networks (RP6)
Office of Rail and Road	Network Rail (PR23)
Civil Aviation Authority	Heathrow Airport (H7)

We structure the review for each sector into the following common topic areas (with some additional material in some cases):

- Key points.
- Broad approach to cost assessment for capital maintenance / asset replacement.
- Consideration given to asset health in setting ex ante allowances.
- Delivery accountability arrangements.
- Cost sharing and adjustments in light of outturn expenditure.
- Use of uncertainty mechanisms to adjust ex ante allowances.

Our review has been used to help inform our work to identify potential options for changes to Ofwat's regulatory framework in relation to capital maintenance and asset health. We caution against reliance on this review for other purposes. While we have endeavoured to provide an accurate description, the actual regulatory arrangements that apply in different sectors can be highly complicated and not fully transparent. It is possible that there are some issues of over-simplification, error or omission in the material set out in this document.

Ofgem: RIIO-2 price controls

Key points

- Our review concerned Ofgem's RIIO-2 price controls for electricity distribution (2023-2028) and gas distribution, electricity/gas transmission (2021-2026). We provide greater detail on electricity distribution (ED) as it seems the most comparable to the E&W water sector in terms of the use of econometric benchmarking to set totex allowances for the 14 DNO licensees across six ownership groups.
- The RIIO-2 price controls use the network asset risk metric (NARM): a monetised value of the failure risk associated with certain assets owned/operated by the network company.
- In ED, a single metric (calculated in line with a common methodology) is used across all assets within scope. Ex ante NARM funding is linked to the delivery of a target NARM score with mechanisms to adjust allowances up or down based on out-turn delivery.
- Ex ante totex allowances are determined using a combination of totex-level benchmarking models (50% weight) and disaggregated benchmarking (50% weight). The disaggregated allowance for asset replacement/refurbishment is based on a view of the work required to deliver the NARM target and unit costs based on historical and forecast industry median unit costs.
- DNOs have some flexibility to under- or over-deliver against their NARM asset health targets without penalty provided the deviation is justifiable. Unjustified under-delivery attracts a penalty of 2.5% of allowed unit cost.
- The PCD framework also supports delivery accountability, with PCDs applied to asset health investment that is not covered by the NARM target.
- Ofgem uses a financial ODI for customer interruptions. The level of customer interruptions are affected by asset health, but there does not seem to be an explicit link between NARM funding and ODI targets.

The network asset risk metric (NARM)

Ofgem's RIIO-2 price controls for all four energy network sectors use a network asset risk metric (NARM) to track the risk associated with the health of network assets, to support mechanisms to fund work associated with the delivery of asset risk targets and to hold network companies accountable for delivering against those targets.

The NARM is a monetised value of the failure risk associated with certain assets owned/operated by each network company. It is computed by multiplying the probability of failure of an asset by the monetised consequences of that failure, aggregated across all failure modes and assets within the scope of NARM. Each sector regulated by Ofgem has its own NARM methodology that governs the calculation of the metric by each company within that sector. The NARM draws heavily on the approach to asset health metrics originally developed in the ED sector in the late 2000s.

In the absence of intervention such as asset replacement, the NARM would be expected to exhibit increasing monetised risk over time, due to assumptions (e.g. informed by asset deterioration models) that failure risk for specific assets increases with asset age. The NARM at a point in time will also be informed by inspections of asset condition.

The NARM does not cover all assets owned and operated by the network licensee. For instance, all non-operational assets (e.g. IT, communications) are excluded from the scope of the NARM. Other sector-specific exclusions apply. For instance, in the ED sector, all underground assets are excluded as are some pole-mounted transformers and circuit breakers.

At the start of the RII0-2 price control period, Ofgem set each licensee a baseline network risk output (BNRO), which is the target NARM score that the company must achieve at the end of the period. The BNRO for each company was proposed by the company itself in its business plan (which Ofgem accepted). Each company is required to report its out-turn NARM score annually, and the performance of the company would be assessed by Ofgem at the close of the price control. This assessment could result in an adjustment to the company's allowances through the NARM adjustment mechanism described further below.

Broad approach to cost assessment for capital maintenance / asset replacement

Electricity distribution (ED)

For ED2, Ofgem's cost assessment approach for the vast majority of costs (98%) involved a combination of totex-level econometric benchmarking (50% weighting) and disaggregated activity-level benchmarking (50% weighting).

To work out modelled costs from its totex-level benchmarking, Ofgem combined the results from three benchmarking models assigning equal weights to each model (i.e. 1/6th weight to overall modelled costs). Each totex-level benchmarking model used a combination of a composite scale variable (CSV) and model-specific drivers:

- Totex benchmarking model 1 used a bottom-up CSV, which was built up by combining activity drivers used in the disaggregated benchmarking models.
- Totex benchmarking models 2 and 3 used a top-down CSV, which was predominantly based on MEAV and network length (73% contribution to the CSV). Model 2 used a 'demand driver' based on the amount of substation capacity released through reinforcement activity, while Model 3 used a different demand driver, i.e. the forecast number of EV charging points and heat pump installations.

Models 1 and 2 used a dataset that covered the period from 2016 to 2028 (i.e. historical data for part of the ED1 period and forecast data for the remaining years), along with a time dummy variable for the ED2 period. Model 3 used a dataset of forecast data only, i.e. 2022-28 without a time dummy variable.

Separately, Ofgem used a more disaggregated or bottom-up assessment of companies' business plans, including activity-level benchmarking of unit costs, review of companies' justification for

proposed volumes and projects and some econometric benchmarking for specific cost categories. For the purposes of this assessment, Ofgem broke down costs into the following categories:

- Load-related capex
- Non load-related capex
- Non-operational capex
- Network operating costs
- Business support costs; and
- Closely associated indirect costs

Asset replacement and refurbishment costs, the two main cost categories of relevance to the health of operational assets, were included in the non load-related capex category. Modelled costs for these activities were built up by combining allowed volumes of replacement/refurbishment work, which was based on Ofgem’s assessment of Engineering Justification Papers (EJPs) submitted by DNOs as part of their business plans, and Ofgem’s estimates of unit costs for those activities, which was based on a combination of benchmarks of sector-wide historical costs and forecasts business plan costs.

Some asset replacement and refurbishment work was considered by Ofgem to be outside the scope of the NARMs mechanism (see non-NARM in the table below). This relates to work on assets that are excluded from the scope of the DNOs’ common network asset indices methodology.

Table 2 RIIO ED2 totex allowances from final determinations (pre-CMA appeal)

Scope of costs	Value over ED2 period
Aggregate totex allowances (all DNOs) (2020/21 prices)	£21,407m
Disaggregated modelled costs for:	
Asset replacement (covered by NARM)	£2,297m
Asset replacement (non-NARM)	£824m
Asset refurbishment (covered by NARM)	£143m
Asset refurbishment (non-NARM)	£263m

In its final determinations, Ofgem’s disaggregated modelled costs for activity covered by NARMs were based on activity volumes submitted by the DNOs in their business plans, which Ofgem eventually accepted in full without adjustment (in its draft determinations, Ofgem had made some

cuts that it reversed in its final determinations) where the EJP was assessed as fully justified. Where the EJP was assessed as partially justified, in some cases Ofgem accepted the submitted volumes in full, and in other cases it used a historical “run rate” to determine volumes or set separate PCDs. These volumes were then multiplied by unit costs derived using the industry median of RIIO-ED1 and submitted RIIO-ED2 costs. In some instances, Ofgem used a higher unit cost where the DNO was able to justify it.

Ofgem also accepted in full the NARMS risk targets (the baseline network risk outputs, BNROs) put forward by the DNOs in their business plan submissions.

Gas distribution (GD)

For GD2, Ofgem used a combination of a single top-down regression model (covering 86% of overall totex), disaggregated modelling (for 8% of totex) and technical assessment (for 6% of totex).¹

The top-down regression model was used for the vast majority of GD totex (including the majority of asset replacement/maintenance costs). The regression model included a composite scale variable (CSV) and two linear time trends (one for historical period and one for forecast) as explanatory variables and covered the period from 2013/14 to 2025/26.

For repex activity (i.e. replacement of gas mains) covered by the top-down regression model Ofgem used what it referred to as a “synthetic” cost driver and assigned a weight of 38.4% to this driver within the overall CSV. The synthetic cost driver was calculated by multiplying the estimated unit cost of replacement activity by Ofgem’s view of the appropriate volume of replacement activity.

Electricity and gas transmission

For electricity and gas transmission, Ofgem’s cost assessment process is more bottom-up and granular compared to ED and GD, and involves the assessment of the volumes of work that the TOs had planned to undertake as set out in their business plans and an in-depth review of the efficient costs of the planned work. Where Ofgem had sufficient data on historical and forecast costs to undertake comparative benchmarking, this was used to determine efficient unit costs.

Consideration given to asset health in setting ex ante allowances

Electricity distribution (ED)

Ofgem’s ED2 totex-level benchmarking combined the results from three totex benchmarking models. One of those models (Model 1) used a bottom-up CSV which is calculated using some variables that are somewhat related to asset health (i.e. number of faults and length of overhead lines affected by trees).

¹ Disaggregated modelling was used to assess costs for certain activities including diversions, streetworks, smart metering etc. Technical assessment was used for bespoke items, large capex projects including replacement works with a value >£5m, demolition of gas holders etc.

Ofgem's disaggregated modelling approach varied by cost category. The two cost categories that relate most directly to the health of operational assets are asset replacement and asset refurbishment. For these categories, the allowed volumes were based on Ofgem's assessment of the DNOs' submitted EJPs (see previous section). Where EJPs relate to work to improve the health of assets, Ofgem's assessment considered the extent to which the proposed work was justified.

Taking UK Power Networks as an example, a total of 93 EJPs were submitted by the DNO across its three licensees (LPN, SPN and EPN) covering all cost areas. Of these, 52 EJPs were assessed as fully justified, 38 as partially justified and three as unjustified. To illustrate the nature of Ofgem's review, in relation to work to reduce leakage from fluid-filled cables, Ofgem noted in its final determinations that the UKPN's approach in the previous price control (ED1) period of using alternatives to full asset replacement could lead to short-term benefits in terms of leakage reduction but may not offer such benefits in the long term. Ofgem said that it would "closely monitor these assets if future funding is requested, taking into consideration the historical investment behaviours."

It was not clear to us from our review whether the full impacts of asset interventions (or lack of interventions) on long-term risk would be reflected in the asset risk metric used for the purposes of the NARM mechanism.

Gas distribution and electricity/gas transmission

For gas distribution replacement activity, Ofgem used its assessed volumes of replacement work when deriving the CSV used in its totex regression model. The assessed volumes were based on a technical/engineering assessment of the work volumes submitted by each GDN in its business plan submissions, which in turn is linked to the proposed NARM target.

For electricity and gas transmission, Ofgem used a bottom-up engineering assessment of the need for asset health activity which the TOs had planned to undertake during the price control period.

Delivery accountability arrangements

Electricity distribution (ED)

For asset health expenditure Ofgem uses two formal delivery accountability mechanisms: NARM and PCDs.

For ED2, Ofgem's NARM approach is summarised below:

- **Setting of ex ante allowances for NARM work:** Ofgem determined the ex ante allowances for NARM-related work by multiplying allowed work volumes (see previous section) by the assessed unit cost of undertaking those work volumes.
- **Setting of baseline NARM network risk output:** Ofgem accepted the DNOs' proposed NARM outputs expressed in terms of the target risk score at the end of the price control period. These NARM outputs are based on the Common Network Asset Indices Methodology (CNAIM), which all DNOs are required to apply when calculating their network risk scores for the purposes of the NARM mechanism. The CNAIM focuses on "condition-based risk", and it combines the probability of a condition-based failure and the monetised consequences of that failure to

calculate a monetised risk metric. A single network risk output target is set for each licensee covering all the asset health work that falls within the NARMs output.

- **Assessment of delivery against NARM outputs:** Ofgem requires DNOs to report their out-turn NARM risk score at the end of the price control period. Ofgem will make an adjustment to the out-turn risk score to remove the impact on the out-turn risk score of any non-NARM asset interventions (e.g. load-related capex such as upgrading a substation to meet new demand) and any external events that have affected the out-turn, so that the delivery assessment only captures the impact of NARM asset interventions on the out-turn risk score.
- **Consequences of under-delivery against NARM outputs:** In the event of under-delivery against their baseline network risk output (after accounting for any adjustments as set out above), Ofgem requires DNOs to submit a report explaining the reasons for that under-delivery. If Ofgem assesses the under-delivery as being justified, there does not appear to be a formal mechanism in the licence for any direct adjustments to ex ante allowances (although Ofgem may be able to make an adjustment via future licence modifications or may adopt a policy of not providing funding for catch-up for under-delivery against the NARM target at subsequent price reviews). Any difference between ex ante allowances and actual expenditure is put through the totex sharing factor mechanism. If Ofgem assesses the under-delivery as being unjustified, Ofgem will make a downward adjustment to ex ante allowances. The downward adjustment is calculated by multiplying the extent of unjustified under-delivery that is in excess of a deadband of 5% of the baseline output by the ex ante unit cost per unit of network risk output. An additional 2.5% uplift is applied to the downward adjustment as a penalty for unjustified under-delivery.
- **Consequences of over-delivery against NARM outputs:** In the event of over-delivery against their baseline network risk output (after accounting for any adjustments), Ofgem requires DNOs to submit a report explaining the reasons for that over-delivery. If Ofgem assesses the over-delivery as not being justified, there is no formal mechanism for any adjustments to ex ante allowances. Any difference between ex ante allowances and actual expenditure is put through the totex sharing factor mechanism. If Ofgem assesses the over-delivery as being justified, Ofgem will make an upward adjustment to ex ante allowances. The upward adjustment is calculated by multiplying the extent of justified over-delivery that is in excess of a deadband of 5% of the baseline output by the lower of the ex ante unit cost per unit of network risk output and the out-turn unit cost per unit of network risk output.
- **Timing of allowance adjustments:** Any adjustments to ex ante allowances for under- or over-delivery would be made as part of the RIIO ED2 close out process after the end of the price control period.

Ofgem's RIIO-2 framework for all four network sectors also includes a price control deliverable (PCD) mechanism. Through the PCD mechanism, Ofgem sets outputs for the network licensee (expressed as a specified piece of work (e.g. upgrade overhead line between point A to point B)). The purpose of the PCD mechanism is to create a formal route for Ofgem to make adjustments to allowances in the event of under-delivery or delay in the delivery of the specified output. Ofgem's final determinations refer to the NARMs adjustment mechanism might be seen as an example of a PCD, but there are important differences between the operation of the NARMs and the PCD

mechanisms that mean that they should be seen as distinct mechanisms within Ofgem's regulatory framework.

There are two broad categories of PCDs: mechanistic PCDs and evaluative PCDs.

Mechanistic PCDs are those where the PCD is specified in the form of a defined number of units to be delivered, and the adjustment to allowances are based on a mechanistic application of a formula set out in the licence. A single unit rate (in £) is specified in the licence and any under-delivery would attract a downward adjustment to allowances based on the product of the under-delivery amount and the unit rate. No adjustments will be made in the event of over-delivery against allowances, and there are no penalties for under-delivery (in addition to the downward adjustment to allowances).

Evaluative PCDs are those where the deliverable is specified as a piece of work to be undertaken by a target delivery date. Each evaluative PCD is associated with an amount of totex allowance that is specified in the licence. At the end of the evaluation period for the PCD (which is typically the end of the price control period) Ofgem will assess the delivery status of the PCD. The assessed delivery status for each PCD could be one or more of the following:

- Fully delivered or fully delivered with an alternative specification (providing equivalent outcomes to the original specification).
- Partially delivered or partially delivered with an alternative specification.
- Delayed.
- Not delivered.

For evaluative PCDs, Ofgem will not make an adjustment to ex ante allowances if the PCD is assessed as:

- fully delivered; or
- fully delivered with an alternative specification and the licensee demonstrates that any underspends against the associated allowances are attributable to efficiency or innovation.

In all other cases, Ofgem may make an adjustment to ex ante allowances as follows:

- If the PCD is assessed as not delivered, Ofgem will reduce ex ante totex allowances by the amount associated with the PCD. Reasonable and efficient costs incurred by the licensee up to the point of decision to not deliver the PCD would be allowed.
- If the PCD is assessed as delayed, Ofgem will re-profile the associated ex ante allowance to match the profile of the actual delivery of the work/expenditure.
- If the PCD is assessed as partially delivered or partially delivered with an alternative specification and the licensee demonstrates that any underspends against the associated allowances are attributable to efficiency or innovation, Ofgem will adjust ex ante allowances so that the licensee retains a proportion of the associated allowances, which is determined as the proportion of the original output or outcome that the licensee has delivered. This only applies if

the licensee provides Ofgem with the information needed to estimate the proportion of output/outcome delivered.

- In all other cases, Ofgem will adjust ex ante allowances so that the licensee is remunerated for the efficient costs of delivering the output/outcomes actually delivered.

No adjustments are made to take account of over-delivery against a PCD.

Gas distribution and electricity/gas transmission

In its RIIO-2 price controls for gas distribution and electricity/gas transmission (GD and T), Ofgem's approach to delivery accountability is broadly similar to the approach described above for electricity distribution.

One notable difference is in the approach to ex post allowance adjustments relating to NARM delivery. Unlike for electricity distribution, for GD and T Ofgem included a more explicit mechanism to make downward adjustments to all under-delivery against ex ante NARM risk outputs, whether justified or unjustified.

Cost sharing and adjustments in light of outturn expenditure

Across all four sectors covered by the RIIO-2 price control framework, the totex incentive mechanism (TIM) is the primary cost sharing arrangement. Under the TIM, licensees are exposed to a proportion of any under- or over-spends against ex ante allowances. This proportion varies by licensee, from around 33% to 50%. The cost sharing rate is symmetrical, i.e. the same proportion applies to under- and over-spends.

All totex (including costs relating to asset health work) is covered by the TIM, except for costs that are specifically excluded. Typical exclusions include costs that are covered by some form of pass-through arrangement (e.g. for the "efficient costs" of dealing with a severe weather event) and costs covered by a use it or lose it (UIOLI) arrangement (e.g. costs of improving visual amenity in AONBs or national parks by undergrounding overhead lines).

In its draft determinations for transmission and gas distribution, Ofgem had proposed to apply a lower effective sharing rate for underspends relating to NARM expenditure (through a mechanism called the delivery adjustment factor – DAF) due to concerns about the potential for windfall gains, but it abandoned those plans by the final determinations stage.

Uniquely for ED, Ofgem's NARM mechanism uses the lower of the ex ante unit cost per unit of risk and the out-turn unit cost per unit of risk when making upward adjustments to ex ante allowances if there is justified over-delivery against the baseline network risk output.

Use of uncertainty mechanisms to adjust ex ante allowances

The RIIO-2 framework includes uncertainty mechanisms (UMs) that can be used to adjust totex allowances during (or at the end of) the price control period. While Ofgem has the power to adjust allowances at any point through the statutory licence modification process, the RIIO-2 framework includes two types of UMs for which the adjustment process is specified in advance and in the licence. These are price control reopeners and volume drivers.

Typically, Ofgem uses UMs in cases where there is material uncertainty about the need, volumes and costs of undertaking work. The use of UMs is decided on a case-by-case basis, and could be sector-wide (common UMs) or company-specific (bespoke UMs).

An example of a reopener for asset health work is the subsea cable repair reopener that allows SSEN Transmission to seek a within-period adjustment to its ex ante allowances if there is a need to undertake repairs on any subsea cable that it operates. There is a materiality threshold of 0.5% of ex ante annual base revenues and two time windows for application (one in 2024 and the other at the end of the period).

An example of a volume driver that relates to asset replacement work is the mechanism to fund work to replace assets that are caught by the polychlorinated biphenyl (PCB) regulations in the ED2 price control, which requires DNOs to replace pole-mounted transformers and associated assets if they are found to contain PCBs. At the time of setting the price control, there was uncertainty about the volume of assets that could be affected by the regulations. The volume driver is based on a single sector-wide unit cost for replacing pole-mounted transformers, which in turn is based on Ofgem's expert view based on historical evidence. Pole-mounted transformers are excluded from the ED common network asset index methodology (and therefore the asset health risk metric) and therefore there is no interaction between this volume driver and the NARM mechanism.

Links between asset health work and outcomes

Ofgem's RIIO-2 framework across all four sectors that it regulates uses financial ODIs to hold companies to account for delivering desirable outcomes and to incentivise improvements in those outcomes. Outside of the NARMs framework, each sector's price controls included a set of targeted ODIs tailored to that sector. Specifically:

- In ED, there are ODIs for customer interruptions with targets set based on company-specific historical performance trends and expectations for improvements in the future.
- In GD, there are ODIs for unplanned interruptions to supplies to customers and for leakage/emissions of gas from the networks. Again, these targets are based on company-specific historical performance trends and expectations for improvements in the future.
- In ET, there are ODIs for energy not supplied (ENS) and insulation and interruption gas (IIG) leakage. The targets for these ODIs are based on company-specific historical performance. Specifically for IIG, the targets for National Grid electricity transmission take account of dedicated funding provided in RIIO-2 by assuming a simple 10% per year improvement over historic performance.
- There are no ODIs in GT that specifically relate to outcomes linked to asset health.

Across all four sectors, there does not seem to be any explicit links between funding provided for asset health improvements and the targets for ODIs, except in the specific case of the IIG incentive for National Grid electricity transmission.

WICS: Scottish Water

Key points

- Our review concerned WICS's Strategic Review of Charges 2021–2027 for Scottish Water.
- At the outset of review, the Commissioning Letter from Scottish Ministers drew WICS's attention to considerations of funding of capital maintenance.
- WICS drew heavily on analysis by Scottish Water on the annual replacement cost across its full set of assets, calculated as the aggregate across assets of MEAV divided by length of asset life. Analysis was done at the level of asset categories; we found limited published information around details.
- WICS set 2040 as the year by which the level of funding should allow Scottish Water to cover that annual level of asset replacement; the target year aligns with obligations on net zero and chimes somewhat with Scottish Water/WICS's views on average remaining life of the company's short- and medium-life assets.
- WICS reports on a comparison of Scottish Water's estimates of asset lives with that from other contexts, concluding they were broadly in line (if anything, WICS suggested Scottish Water's figures point to longer lives). We saw no published details of the analysis used.
- WICS worked backwards, to calculate the annual rate of growth in charges, compared to CPI, needed to deliver that level of funding for capital maintenance by 2040, making assumptions on a number of parameters (e.g. on residential and business customer growth, on levels of opex, on annual borrowing from Scottish Government and on CPI rates).
- To the best of our knowledge there are no explicit financial ODI or PCD-type arrangements in place in relation to capital maintenance and asset health.

Background

The Water Industry Commission for Scotland (WICS) concluded at the end of 2020 its strategic review of charges for Scottish Water for the April 2021 to March 2027, setting the maximum revenue from charges for the company over that period. Scottish Water is a public company, accountable to Scottish Ministers and Scottish Parliament.

Considerations on the funding of capital maintenance took centre stage in WICS's review. This was in line with it having been one of the significant areas which the Scottish Government had drawn WICS's attention to in its commissioning letter at the start of the review process:²

Capital Maintenance - Over this and future regulatory periods, Scottish Water should continue the transition to a risk based approach to maintaining the overall condition and performance of its assets so as to ensure no deterioration of service levels to customers over the long term. Ministers recognise the increasing importance of capital

² See WICS (2020) *Strategic Review of Charges 2021-2027 Draft determinations*,, pages 88 ff.

maintenance in achieving and maintaining service levels and statutory obligations in relation to drinking water quality and the environment and to reflect customer priorities that may affect longer term asset planning. This requires to be efficiently planned and delivered over successive regulatory periods. They wish the Commission to ensure that there is a stable and sustainable funding regime for this important part of the investment programme.

The regulatory process followed in the review of charges process took just over four years, from 2017 through to early 2020. On this, and by way of background to the review that we outline below, we highlight the following aspects and milestones of that process:

- Early in the process, a body called the Customer Forum was created by an agreement between WICS, Scottish Water and Citizens Advice Scotland to play a “formal role in facilitating effective engagement and acting as a conduit for customer views in the context of the [Strategic Review of Charges] 2021–27.”³ A similar body had been created for the previous price control period.
- WICS produced a series of decision papers in the period to early 2019. These set out the Commission’s emerging views on a range of areas – including on asset replacement – culminating in a decision paper with its views on the regulatory parameters for the control period and the long-term profile of charges. In developing those papers, WICS was mindful of Scottish Government guidance and objectives for 2021 – 2027, drew on consultations with stakeholders and on an initial outline plan of Scottish Water.
- Scottish Water’s Strategic Plan was agreed with the Customer Forum. Given such agreement was secured, and in line with what was envisaged in the agreement setting up the Customer Forum, WICS made draft, and then final, determinations that fully reflected the terms of the business plan agreed between the two.

The points picked up above reflect a goal, repeatedly emphasised in WICS documents over the price review, of avoiding “adversarial regulation” and that “Scottish Water should work collaboratively with its owner [i.e. the Scottish Government], its customers and its other stakeholders to co-create a clear Strategic Plan”.⁴

Broad approach to cost assessment for capital maintenance / asset replacement

WICS gave significant importance to addressing the funding of asset replacement, reflecting the indications of the Scottish Government quoted earlier. The regulator considered that a step-up in such funding would be necessary in the light of the growth in enhancements over earlier price control periods – made to meet higher service and performance levels that had been set – and also in order to enable Scottish Water to meet the target set by Scottish Ministers of meeting net zero carbon emissions by 2040.

³ (2017) *Co-operation agreement among WICS, Scottish Water and Citizen’s Advice Scotland*.

⁴ WICS (2018) *Strategic Review of Charges 2021-2027 Methodology refinements and clarifications*, page 7.

This latter point, relating to the net zero carbon target, appears to have played a significant role in WICS's explanation of its approach, which includes the following reasoning on this:⁵

[A] critical enabler of meeting its emissions reduction commitment will be that Scottish Water is able to meet its asset replacement needs when it is efficient to do so. Otherwise, Scottish Water may have to rely on short-term interventions which would likely result in higher carbon and resource use.

To the best of our knowledge, WICS did not refer to or put forward evidence to support the hypothesis implicit in its position on this point.

Over the review process, and drawing on evidence brought forward by Scottish Water, WICS estimated a *target* level of annual expenditure on asset replacement that the company would need to be doing by 2040. This then formed a basis for determining the level of funding for asset replacement over the 2021 – 2027 price control period. We review, in turn, the two legs of the question, namely:

- the calculation of the target level of expenditure on asset replacement by 2040; and, given this,
- the determination of funding for asset replacement in the 2021 – 2027 period.

Determining a target level by 2040

WICS put forward an estimate of the annual expenditure on asset replacement cost that Scottish Water should carry. For this, it drew, on analysis presented by the company. In particular, Scottish Water produced analysis on the replacement cost and on the asset life across its full set of assets. On each of those dimensions – replacement cost and asset life – the company put forward a range of values. The results of this analysis, which are shown within a WICS decision paper, report the values at the level of categories of assets. For example, for raw water pumping stations, the replacement cost was estimated to be between £90 and £160 million (2017/18 prices), and their asset life to be in the range of 25 to 50 years.⁶ We found limited details in published documents on the analysis underlying these estimates. We understand that asset replacement values were based on estimates of Modern Equivalent Asset Values. For each asset category, the initial range of estimated replacement cost and of asset lives was narrowed to reflect the level of confidence that Scottish Water has in its estimate of those two dimensions: as we understand it, this led it to put forward a narrower or wider range around the central estimate depending on Scottish Water's level of confidence around its estimates.

Grouping asset categories into (i) short-medium life assets or (ii) long-life assets, Scottish Water's analysis produced estimates of a range of the annual replacement cost. For each of those two broad groups, this was the sum across the relevant asset categories that fall within it of the ratio of the replacement cost and the asset life, i.e. the aggregate of an average annual asset replacement cost.

⁵ WICS (2020) *Strategic Review of Charges 2021-2027 Final Decision Paper: Prospects for Prices*, page 33.

⁶ WICS (2019). *2019 Decision paper: Strategic Review of Charges 2021 – 2027 asset Replacement*, page 21.

WICS considered that the company's estimates of replacement costs and asset lives seemed broadly reasonable and that if anything, the company had been optimistic regarding the length of life of its assets.⁷ Information on WICS' analysis underlying that conclusion is not shared in the published documents, as far as we can tell.

On the back of Scottish Water's analysis on replacement costs and asset lives of its current assets, WICS found that the company should target, annually, £430m for replacement of its short and medium life assets, and between £190m and £340m for replacement of long-life assets (value in 2017/18 prices).

WICS added a further £130m to £180m as an estimate of the average annual replacement costs of those assets related to the enhancement and growth investments which Scottish Water is expected to carry out in the period to 2040. WICS shared few details of the analysis behind that range of estimates, beyond stating that it took account of the likely mix of short, medium and long live assets in the company's enhancements and growth, and referred to the annual £300m of enhancements and growth which Scottish Water is expected to carry out over the next 20 years.⁸ The estimated range was calculated when WICS was using 2045 as the target date and was not revised, as far as we can tell, when the target date was brought forward to 2040.

Determining the allowance for 2021 – 2027

Our understanding is that to calculate the contribution to the level of the allowance for the 2021 – 2027 period such that it funds asset replacement, WICS drew on the target level of asset replacement for 2040 and worked backwards.

In particular, WICS considered what growth in charges, above CPI, would be needed to reach that level of funding by 2040, given a set of the assumptions that it made on a number of other key aspects. These assumptions include ones on connections growth, on level of borrowing available from the Scottish Government and on levels of what is labelled as "Tier 1" expenditure, which relates to broadly recurring expenditure and covers operating costs, PFI contract fees, interest costs, responsive repair and refurbishment, and reasonable cost contributions to developers. Further to making assumption on those aspects, WICS formulated its calculations for a number of scenarios, reflecting different assumptions on three further aspects namely on the assumed on-going opex efficiency improvements, on the extent of additional costs associated with considering emissions in investment appraisals and on the assumed level of investment needed by 2040.⁹

From that analysis, WICS draws a view that allowances would need to increase, in the years to 2040, by CPI plus 1% – 2%, and it suggested a figure closer to the upper end. WICS considered the question of how to profile such increases in the period to 2040. For the immediate regulatory period, 2021 to 2027, WICS proposed that the maximum charges would be set at CPI plus 2%.

Ring-fencing of allowances

⁷ WICS (2019). *2019 Decision paper: Strategic Review of Charges 2021 – 2027 asset Replacement*, page 28.

⁸ WICS (2019). *2019 Decision paper: Strategic Review of Charges 2021 – 2027 Asset replacement*, page 30.

⁹ WICS (2019). *Final decision paper: Strategic Review of Charges 2021 – 2027 Prospects for prices*, pages 46ff.

The allowance set by WICS which covers the funding relating to asset replacement is not ring fenced. It is intended to cover the funding across the set of activities to be carried out by Scottish Water.

That said, there is an additional allowance intended to “cover any additional costs that Scottish Water has incurred in selecting an option that has a higher net present value (NPV) after allowing for externalities such as carbon, natural and social capital than the lowest financial cost option. Scottish Water will only be able to access this ring-fenced allowance if it is clearly evidenced in an appraisal.”¹⁰ This additional allowance, which could cover expenditure arising from asset replacement or capital maintenance, and indeed enhancements, is ring-fenced.

We note that in one of the decision papers produced earlier in the review period, and in relation to a discussion around the funding that would be required for asset replacement, WICS had aired the suggestion that Scottish Water could offer for some of its allowance to be ring-fenced. In particular:¹¹

- *Scottish Water should consider offering to ‘ring-fence’ some proportion of its allowed for revenue and propose external verification of its approach to understanding and evidencing its need for asset replacement;*
- *Increased funding for asset replacement would be released from the ring fence when Scottish Water can: Establish a consensus on the amount that will need to be spent; [show] progress in line with the advice of the independent expert on asset information and asset management and; [evidence] how it proposes to spend the resources available.*
- *[An] investment planning and prioritisation framework will play an essential role in building confidence in this evidence.*

We did not find references to such suggested ring-fencing arrangements in later documents of the review process, namely in the draft or final determinations.

Consideration given to asset health in setting ex ante allowances

As reflected in the discussion above, WICS’s determination gave considerable attention to considerations around capital maintenance and to concerns about replacing assets at the end of their lives. We did not find any discussion or analysis that linked directly to evidence on asset health (i.e. links between estimated asset lives, asset failure and impacts on outcomes), accompanying those considerations, beyond the general observation that an inadequate approach to capital maintenance and asset replacement raised risks of asset failures with a consequential harm on performance and service levels.

Delivery accountability arrangements

To the best of our knowledge there are no explicit financial ODI or PCD-type arrangements in place.

¹⁰ WICS (2020) *Draft determination: Strategic Review of Charges 2021 – 2027 Prospects for prices*, page 6.

¹¹ WICS (2018). *2018 Decision paper 5: Strategic Review of Charges 2021 – 2027 Capital maintenance*, page 6.

We note that as part of their Annual Returns, Scottish Water must provide data on its asset inventory, by asset categories. This includes information on units as well as on Gross and Net Modern Equivalent Asset Value.¹²

There is a governance process around Scottish Water's investment programme, which covers asset replacement. This is called the Investment Planning and Prioritisation Framework (IPPF). In broad terms, the framework involves an ongoing process whereby potential investments are moved forward and prioritised or, conversely, deprioritised, in line with changing needs and opportunities.¹³ As part of that framework, two groups were created: the Investment Planning and Prioritisation Group (IPPG) – with the more high-level purpose of governing the development of the future investment programme and of monitoring development towards the objectives of the Scottish Ministers – and the Delivery Assurance Group (DAG) who is tasked with seeking reassurance on the delivery of projects being carried out. The terms of reference for the DAG make it clear that the focus of the DAG is on the delivery of the projects: what is the progress against Scottish Water's delivery plan and what is the progress on individual projects?

Cost sharing and adjustments in light of outturn expenditure

To the best of our knowledge there are no conventional cost sharing arrangements in place (i.e. the type applied to water companies in England and Wales). This may reflect the status of Scottish Water as a public company. As such, the price control acts as a constraint on overall budget, beyond any revisions to levels of borrowing from Scottish Government that were assumed.

The revised methodology published by WICS in the course of the review does set out that “there will be scope for the capital expenditure allowance to be increased during the regulatory period; for example from the proceeds of out-performance (subject to Minister's approval) or the agreed release of funds from the ring-fenced allowance.”¹⁴ The availability of funds from the ring-fenced allowance intended to fund Scottish Water when the company selects investments that are not necessarily the lowest on an NPV basis but, for carbon or other reasons are desirable, is discussed throughout the review process through to final determinations.

Use of uncertainty mechanisms to adjust ex ante allowances

We did not identify the existence of an explicit uncertainty mechanism to adjust Scottish Water's allowances as part of the final determinations.

¹² WICS (undated) *Asset Inventory and System Performance: Reporting Requirements – Section H*

¹³ Details on process are set out in Scottish Government (2021) *Strategic Review 2021 to 2027 (SR21) Governance Explanatory Note*.

¹⁴ WICS (2018) *Methodology Refinements and Clarifications Strategic Review of Charges 2021 – 2027*, page 11.

Utility Regulator: NI Water

Key points

- NI Water acts as the regulated water company in Northern Ireland. This review covers the Utility Regulator's determination for the PC21 price control, covering the 2021-2026 period, as well as reconciliation of the previous price control period.¹⁵
- NI Water is publicly owned. The allowance set by the UR for NI Water acts more like a budget, rather than an ex ante allowance subject to cost sharing.
- The UR benchmarked NI Water against water and sewerage companies in England and Wales separately for operating expenditure and capital maintenance expenditure.
- Asset age explanatory variables were included in models of wholesale water capital maintenance, wholesale sewerage capital maintenance and wholesale sewerage opex.
- NI Water raised concerns that differences in cost allocation across companies caused issues for the approach to benchmarking opex and capital maintenance separately.
- NI Water proposed bottom-up engineering assessments. These were rejected by the UR for its main modelling approach, although it did perform some form of cross-checks with more bottom-up evidence.
- The UR provided historical analyses for a number of key serviceability indicators for NI Water, as a means of evaluating whether capital maintenance allowances derived from its econometric models were likely to be sufficient but did not see a need for adjustment.
- Some allowance was provided for 'consequential capital maintenance', to cover the increase in capital maintenance resulting from increased enhancement expenditure (i.e. where the improvements to deliver a new standard make it necessary to replace an asset with some residual life).

Broad approach to cost assessment for capital maintenance / asset replacement

The UR's cost assessment for NI Water was undertaken separately for operating expenditure, capital maintenance and enhancement expenditure. For both operating expenditure and capital maintenance expenditure, the UR carried out benchmarking of NI Water against water companies in England and Wales. This econometric modelling was undertaken by CEPA on behalf of the UR and complemented by cost assessment working groups including the former and NI Water. The UR noted that data on the E&W water companies had been published by Ofwat prior to PC21 model design.

As part of its reflection on the modelling process, CEPA noted that it was only possible to develop models at a high level of aggregation due to challenges in obtaining robust, granular data.

¹⁵ UR (2021) *PC21 Final Determination – Main Report May 2021*

Modelling was undertaken separately for opex and capital maintenance expenditure, with separate models for water and sewerage for each.

A key point of focus for CEPA in the water and wastewater model development strategy was the desire to avoid excessive complexity. This included a top-down approach to water and wastewater models, excluding bioresources from sewerage models (due to differences in sludge treatment processes between NI Water and E&W water and sewerage companies), and avoiding complex inter-variable relationships.

Initial models included only a constant and scale explanatory variable, with subsequent iterations including additional explanatory variables.

Wholesale water model specifics

The UR identified expenditure on maintaining the long-term capability of the assets (infrastructure) and expenditure on maintaining the long term capability of the assets (non-infrastructure) as components of the dependent variables for both its wholesale water maintenance and wholesale sewerage maintenance models, with the exclusion of sludge/bioresources from wholesale sewerage maintenance modelling.

In its modelling the UR identified power, bulk supply, renewals expensed in year (infra & non-infra), other opex, and non-typical expenditure as components of its dependent variable in wholesale water opex models.

The UR identified scale, density, water treatment complexity and network complexity / topography as the most important drivers of wholesale water opex and capital maintenance based on the data available.

This fed into the following explanatory variables in the wholesale water opex models: length of mains, number of booster pumping stations per length of mains, the percentage of water treated in complexity bands 4 to 6, weighted average treatment complexity, the percentage of water input from pumped reservoirs, connections per length of mains, connections per length of mains squared, and post-2014/15 UK GAAP accounting treatment.

The explanatory variables for wholesale water capital maintenance models excluded the variables for weighted average treatment complexity and percentage of water input from pumped reservoirs and included the percentage of mains after 1981.

Wholesale sewerage model specifics

The UR identified power, discharge consents, bulk discharge, renewals expensed in year (infra & non-infra), other opex, and atypical expenditure as components of its dependent variable in wholesale sewerage opex models.

The UR identified scale, density, economies of scale in sewage treatment, and age of the network as the most important drivers of wholesale sewerage opex and capital maintenance based on the data available. This fed into the following explanatory variables in wholesale sewerage opex maintenance models: total length of sewers, the percentage of load treated in size bands 1 to 3, the

percentage of sewer laid or structurally refurbished post-2001, connections per length of mains, connections per length of mains squared, and a variable for post-2014/15 UK GAAP accounting treatment.

The explanatory variables for wholesale sewerage capital maintenance excluded the percentage of load treated in size bands 1 to 3 and replaced connections per length of mains with connections per length of sewers, however retained the squared connections per length of mains variable.

NI Water raised concerns that the aggregated Botex approach used for capital maintenance assessment by Ofwat in England and Wales was not comparable to the disaggregated modelling employed by the UR, on the grounds that companies in England and Wales have a degree of flexibility surrounding their allocation between capital maintenance and operational costs, leading to distortion in the econometric comparison of capital maintenance costs. In response to this the UR performed an econometric comparison of the Botex and separate Opex and capex modelling approaches, finding the similarity in average predicted costs between the two approaches were sufficient to support the UR's initial conclusion that the disaggregated Opex and capital maintenance models were consistent with the Botex model results. This did not however seem to address the risk that estimates of upper quartile costs could be distorted by differences across companies in the mix of operating expenditure and capital expenditure.

NI Water had proposed the use of some bottom-up engineering assessments as part of its business plan for PC21. However, the UR argued that further work was necessary to ensure the reliability of such outcomes. Additionally, the UR noted that these engineering assessments require further work to have confidence in the outcome of the approach "which continues to be subject to management adjustments".¹⁶ Despite this, the UR did make use of a bottom-up assessment of base maintenance for the purposes of sense-checking against its top-down assessment. Specifically, this included: a comparison between historical unit costs of delivery and run rates of expenditure for items of work which continued from PC15 into PC21, a review and challenge of the scope of works or the quantity of activities included in the business plan costings, an assessment of the company costing systems undertaken by the Reporter and updated for the final determination, adjustments to some of the company's allocation of investment by purpose (enhancement / base) and by service (including a systematic reallocation from infrastructure investment to non-infrastructure investment for service reservoir rehabilitation, metering and ICT), and adjustments to the application of efficiency to take account of reprofiling of the capital programme.

Consequential capital maintenance

The UR provided an additional allowance for what it refers to as 'consequential capital maintenance'. This is £114 million on average per year, of this £114 million approximately £18.6 million per year is allocated for consequential Capital maintenance. The UR described this as additional expenses that are incurred as a result of enhancement expenditure, for instance, the need to replace an asset with some remaining life as a result of working to achieve a new standard.

¹⁶ UR (2021) *Final Determination – Annex I Capital Investment May 2021*, page 15.

The UR evaluated the relationship between capital maintenance expenditure and the number of consumers for the England and Wales water companies, which it used to benchmark NI Water's costs. The UR compared capital maintenance expenditure and capital enhancement expenditure and identified that NI Water is an outlier in respect of the scale of the capital enhancement programme when compared with the companies used to determine the benchmark level of capital maintenance and allowed NI Water additional funding on this basis.

Consideration given to asset health in setting ex ante allowances

Variables relating to asset age were used in both wholesale water and wholesale wastewater econometric models, as the percentage of mains installed post-1981 within the wholesale water capital maintenance models, and as total length of sewer laid or structurally refurbished post-2001 and % sewer laid or structurally refurbished post-2001 within the wholesale sewerage opex and capital maintenance models.

In addition, the UR made use of asset serviceability metrics as a means of double-checking that capital maintenance allowances derived from those econometric models had been both sufficient and efficiently applied over time e.g. service targets for interruption to water supplies.

For this assessment, there were four service areas: water Infra, water non-infra, sewerage infra, and sewerage non-infra. Each of the service areas has several serviceability indicators, of these each area had one primary indicator, which was given more weight than the others.

We reproduce below the table from the UR's final determination with list of indicators used for the serviceability assessment, with the primary indicators marked in bold.

This list comprises what the UR describes as: service indicators, asset performance indicators, and sub-threshold indicators. There is some overlap between the UR's indicators and Ofwat's performance commitments.

Figure 1: UR table of serviceability indicators

Service	Indicator
Water Infra	Mains bursts per 1,000km
	Interruptions to supply greater than 3 hours resulting from equipment failure
	DG3 percentage of properties affected by interruptions greater than 12 hrs (unplanned & unwarned)
	Percentage of regulatory Iron samples exceeding 75% of the drinking water standard PCV
	Customer contacts per 1,000 population (Discoloured water)
	Distribution losses (explanatory only)
Water Non-infra	Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU
	Number of regulatory THM samples exceeding 75% of the drinking water standard PCV
	Events at WTW resulting from treatment difficulties or ineffective treatments categorised as 'significant' or higher
	Percentage of regulatory samples taken for coliform bacteria at Service Reservoirs exceeding the drinking water standard PCV
Sewerage Infra	Sewer collapses per 1,000km
	Sewer blockages per 1,000km
	Number of H, M and L pollution incidents from the sewer network (CSOs, rising mains and foul sewers)
	Properties flooded in the year (other causes)
	Total number of equipment failures repaired
Sewerage Non-infra	Percentage of WwTW discharges not compliant with numeric consents
	Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value
	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value
	Percentage of total population equivalent served by WwTWs not compliant with numeric consents

Source: UR (2021) *PC21 Final Determination – Main Report May 2021*, table 3.1

In its final determination for PC21 the UR provided several charts of the above serviceability indicators over time, with some indicators having tramlines overlaid representing the upper and lower control limits around a reference level of performance. The methodology for determining the years that contributed to the reference level varied by indicator. The historical aspect of the charts served as a sense check exercise to ensure that historical levels of funding had been both sufficient and efficiently used by NI Water to provide the desired level of service. The reference levels and limits also serve as the serviceability limits for the upcoming price control period and a means of checking that the allowances derived from modelling are sufficient in light of historic expenditure levels and serviceability metrics.

Delivery accountability arrangements

As part of NI Water's obligations surrounding serviceability metrics it was required to provide an annual serviceability submission, alongside an assessment of whether serviceability was improving, stable, marginal, or deteriorating.¹⁷

In the event that serviceability is found to be declining then the company is required to identify the source of the decline and outline the steps it will take to restore stability. If serviceability is found to be deteriorating, the company is required to submit a formal action plan, with the progress of the plan being monitored regularly by the UR. If the UR evaluates the company's action plan to be inadequate, or it fails to deliver the action plan, or the delivery of the action plan did not restore stable serviceability, the UR would then consider logging down the cost of work necessary to restore serviceability, whether it proceeded to take enforcement action or not.¹⁸

The UR considers several other components for possible ex post adjustment: any difference in capital cost inflation relative to the assumptions which were applied in the PC15 final determination, any change in budget relative to the allowances in the PC15 final determination, and any change to the outputs which will be delivered in the PC15 period relative to those included in the PC15 final determination. The UR stated the following: "The value of additional outputs delivered by the company has been added to the RCV and the value of outputs the company has not delivered has been deducted from the RCV – a process commonly known as logging up and logging down. The net change in the RCV at the start of PC15 due to logging up and logging down is a reduction of £88.4m in 2012-13 prices."¹⁹

In addition to the above targets, the UR also provided a set of 'development outputs' across a range of areas for PC21. These related to areas that the UR felt were necessary areas of development for NI Water in order to develop its capability and introduce new techniques, however lacked numerical targets in the short or medium-term (either due to lack of historic data or incompatibility with numeric measurement). Of this long list several appear relevant for this body of work, namely: Targeting mains renewals in high leakage areas, Leakage innovation, Smart networks – ITS strategies, WwPS / CSO Quality (UID) and WwPS (Capacity increase), Storm water separation, real time network monitoring, and several other outputs relating to specific monitoring areas.

¹⁷ UR (2021) *Final Determination – Annex F Asset Serviceability May 2021*, page 4.

¹⁸ UR (2021) *Final Determination – Annex F Asset Serviceability May 2021*, page 16.

¹⁹ UR (2021) *Final Determination – Annex H PC15 Out-turn Report May 2021*, page 2.

Figure 2: UR table of development objectives for PC21

Ref	Development Objective	Sub-Prog
01	Consumer Engagement	N/A
02	Consumer Protection / Customer Care Register	N/A
03	NI Water Alpha Ltd - WTWs Treatability Improvements	SP04a
04	DWD Recast & Emerging Issues Study	SP04z
05	Refresh of DG2 Register	SP08z
06	Targeted Mains Renewals in High Leakage Areas	SP08z
07	Leakage Innovation	SP09z
08	Smart Networks – ITS Strategy	SP09z
09	WwPS / CSO Quality (UID) and WwPS (Capacity increase)	SP12b & 12c
10	Event Duration Monitors WwPS/CSOs	SP12b
11	Cranfield Catchment, Killeel Storm Separation	SP12g
12	Storm Water Separation	SP12g
13	Real Time Network Modelling	SP12z
14	Urban Drainage Modelling - Live Models for IOC	SP20g
15	Innovation Initiatives	SP20g
16	Urban Drainage Modelling - Studies to Inform PC27 - Top 271 Priority Drainage Areas	SP20g
17	Raw Water Trunk Main Rehabilitation	SP20 & 23c
18	Culmore DA KL554 - Skeoge Link Road	SP24a
19	LWWP Networks	SP12b & 12d
20	LWWP Wastewater Treatment Works	SP16b
21	AD - Asset Strategy - Wastewater Asset Performance Modelling	SP20g
22	AD - Asset Strategy - Water Asset Performance Modelling	SP20g
23	Facilities H&S Compliance	SP20e
24	Smart metering	SP19
25	Addressing scope uncertainty for the Mid-term Review	N/A

Source: UR (2021) *PC21 Final Determination – Main Report May 2021*, table 3.1

Cost sharing and adjustments in light of outturn expenditure

Unlike the privately owned water companies in England and Wales, NI Water is a publicly owned entity. Consequently, the cost assessment process differs to that of E&W companies. In particular, the allowance determined by the UR for NI Water acts more like a budget, rather than an ex ante allowance subject to cost sharing.

For post-PC15 assessment the UR noted that NI Water had under-spent its budget by £33.1m in nominal terms, however due to lower than expected inflation over the period this reflected an increase in expenditure of £7.1m in real terms. This variance in expenditure was assessed as a

single category (rather than as a detailed assessment by capital sub-programme). The UR determined that an RCV adjustment was not necessary:

*“Consistent with our approach in the PC15 final determination, we have concluded that it would not be appropriate to adjust the RCV to reflect changes in base maintenance investment. If the company did not continue to invest at planned levels or serviceability had not been maintained, we would then seek further information on the application of base maintenance investment”.*²⁰

Use of uncertainty mechanisms to adjust ex ante allowances

The UR plans to undertake a mid-term review, with the following goals:

- Allow a managed change in funding to realign the revenue and outputs with any substantive change to medium-term funding levels.
- Provide an opportunity to implement innovative and sustainable solutions which might develop from the strategic studies which NI Water carried out in the early part of the price control.

The UR notes that, through the Memorandum of Understanding, the Consequent Written Agreement and the Change Control 103 Protocol, it maintains the ability to manage annual changes in capital and opex within the public expenditure funding regime NI Water also operates within. Within these existing processes the UR has the option of re-determining K factors to take account of changes in investment levels or increased or reduced costs, noting that: *“Any re-opening of the financial determination under the Consequent Written Agreement would be comprehensive and symmetrical in that it should consider all relevant changes the company has faced, positive and negative.”*²¹

Given the burden placed on both the company and the regulator in undertaking the mid-term review, the UR determined that it should serve as the only re-opener for PC21. This means that any financial changes not captured in the mid-term review would not be reflected in charges until the next price control.

Specific factors that are considered in the mid-term review:

- Any relevant items bids already determined as part of the regular monitoring of the company to the extent that they impact regulatory funding.
- Any material change to capital funding determined through the change control protocol including any material increase or decrease in capital maintenance investment.
- Any material change in customer numbers and demand.
- Any material change in costs which cannot be defined with any certainty in the business plan – for example the cash tax position of the company.

²⁰ UR (2021) *Final Determination – Annex H Asset Serviceability May 2021*, page 7.

²¹ UR (2021) *PC21 Final Determination – Main Report May 2021*, page 103.

Utility Regulator: NIE Networks

Key points

- NIE Networks acts as the regulated electricity transmission and distribution company in Northern Ireland. Our review primarily covered the RP6 price control (2017-2024), but also takes some account of the UR's ex post assessments for the RP5 period, and intentions laid out in the RP7 draft determination.²²
- The cost assessment at RP6 involved different approaches for: (a) IMF&T costs (inspections, maintenance, faults and tree cutting) and indirect costs (e.g. network design & engineering); and (b) direct network investments (involving physical contact with network system assets).
- Each of IMF&T and indirect costs straddle opex and capex. The UR used an allocation factor to allocate IMF&T and indirect costs between opex and capex, based on the proportion of these costs capitalised by NIE.
- Allowances for IMF&T and indirect costs were determined using benchmarking against comparator GB DNOs.
- Direct network investment was determined through a bottom-up assessment of investment proposed by NIE, including an assessment of the volumes of work which the company planned to deliver in RP6 and comparisons of unit costs versus those of NIE historically.
- The UR Introduced a reliability incentive mechanism and related reliability incentive payments scheme, based on measures of reliability performance.
- The UR acknowledged Ofgem's use of metrics for asset health / monetised risk, however rejected this for RP6, arguing that its regulatory focus is outcomes rather than techniques or process.
- There is 50:50 cost sharing for over- and under-spend, combined with a 'deferral mechanism' (introduced previously for NIE Networks by the CMA) intended to prevent double funding in the event of deferral of planned investment.

Broad approach to cost assessment for capital maintenance / asset replacement

There are no direct comparator companies for NIE within Northern Ireland, but the UR drew in part on comparisons with electricity distribution companies in Great Britain.

The cost assessment of capital maintenance for NIE is carried out separately, using different techniques, for the following two broad categories:

- IMF&T (inspections, maintenance, faults and tree cutting) costs and indirect costs.
- Direct network investment costs.

²² UR (2017) *Northern Ireland Electricity Networks Ltd Transmission & Distribution 6th Price Control (RP6): Final determination 30 June 2017.*

IMF&T and indirect costs

The costs that the UR label 'IMF&T' costs represent the majority but not all of a wider category of costs that Ofgem labels 'network operating costs'. Indirect costs include costs in areas such as network design and engineering, project management, network control centre, human resources, finance and regulation.²³

The UR's benchmarking analysis for IMF&T and indirect costs tuts across both NIE Networks' capex and its opex. As the UR includes allowed capex but not allowed opex in the calculation of NIE Networks' RAB, it was necessary to separate allowance for indirect and IMF&T costs between opex and capex. This was achieved by applying an allocation factor based on the UR's calculation of the proportion of NIE Networks' indirect costs and IMF&T costs that were capitalised by NIE.

The UR determined annual allowances for NIE Networks' indirect costs and its costs for IMF&T based on the results from benchmarking analysis covering NIE and 14 electricity distribution network companies in GB.

The UR provided a total of 6 models for IMF&T and indirect costs, all in log-log form. The cost drivers included in these models were:

- network length;
- network density;
- composite scale variables (CSV) which gave a 50% weight to network length, 25% to customer numbers and 25% to units distributed;
- proportion of overhead line as a percentage of total network length.

Additionally, some models included year-specific time dummies.

The UR noted that Ofgem used a totex approach at RIIO-ED1, consisting of a 50% weighting towards totex econometric modelling and a 50% weighting towards disaggregated bottom-up modelling. It however argued that a totex approach would not be suitable for NIE, due to the capex requirements of NIE likely varying significantly from those of GB DNOs and consequently did a mixture of top-down and middle-up assessment for IMF&T and indirect costs.²⁴

The UR obtained assistance from CEPA in formulating its modelling approach for RP6. Similarly, NIE employed NERA as a consultant for its modelling suggestions. NERA replicated the disaggregated bottom-up models used by Ofgem at RIIO-ED1, however CEPA, alongside replicating Ofgem's models, developed independent models comprising a set of top-down and middle-up models (total direct opex, total load-related capex) for inspections, maintenance, faults and tree cutting. More specifically, the UR's definition of middle-up models is split by activity and opex/capex but not at the most disaggregated level. "For RP6 these would be: Load-related, non-load related, network investment – core, network investment – non-core, network operating costs

²³ UR (2012) *Northern Ireland Electricity Transmission and distribution price controls 2012-17 Final determination 23 October 2012*.

²⁴ UR (2017) *Northern Ireland Electricity Networks Ltd Transmission & Distribution 6th Price Control (RP6) Final determination 30 June 2017*, page 84

(NOCs), business support, closely associated indirect costs (CAI), overall capex, overall opex (IMFT and indirect costs).²⁵

Alongside CEPAs model estimations, the UR drew on an assessment of NIE Networks' efficiency under each model. The efficiency gap of NIE was compared to the 4th placed company (of 15 total comparator companies) as an approximation of an upper quartile level of cost performance.

Direct network investment

The UR defined direct investments as “those activities which involve physical contact with network system assets such as refurbishment or reinforcement of existing assets and the creation of new assets”.²⁶

Funding for direct network investment was treated in one of the following ways for RP6:

- Funding for direct network investments investment for which an ex-ante allowance is included in the determination.
- Investment carried out under the re-opener mechanism where an estimate has been included for costs which will be determined at a later date when the need for the project has been confirmed and the scope, cost and programme developed.
- Investment in undereaves service replacement which is subject to a volume driver.

Ex-ante direct network investment figures were based on a detailed bottom-up assessment of investment proposed by NIE Networks including an assessment of the volumes of work which the company planned to deliver in RP6.

The outputs were divided into two categories:

- Those where it was possible to identify a volume of activities and associated costs. Unit costs were calculated for these activities.
- Those where a lump sum was identified to fund a general activity for which no specific outputs had been identified.

Additionally, there were no pre-defined outputs attached to direct network investment defined as lump sum activities and no specific outputs were attached to the indirect costs including those associated with the delivery of direct network investment.

For RP5 the UR introduced annual cost reporting against Regulatory Instructions & Guidance (RIGs) to provide information on the delivery of the current price control and to benchmark and challenge future business plans.

²⁵ CEPA (2017) *RP6 EFFICIENCY ADVICE THE NORTHERN IRELAND UTILITY REGULATOR (UR) MARCH 2017 FINAL REPORT*, page 10

²⁶ UR (2017) *Northern Ireland Electricity Networks Ltd Transmission & Distribution 6th Price Control (RP6) Final determination 30 June 2017*, page 182

In its RP6 business plan, NIE Networks included £376.0m of direct network investment. The UR's final determination reduced this by £39.6m. The majority of reductions came as a result of unit cost adjustments based on RP5 outturn costs. Some RP6 volumes were also adjusted to reflect RP5 run rates and, in some cases, due to what the UR felt were insufficient justifications in the RP6 Network Investment Plan. This approach included modelling of the asset replacement volumes using NIE Networks' asset age profiles and industry-accepted asset lives.

Consideration given to asset health in setting ex ante allowances

The UR considered factors such as asset health and asset age as part of its review of NIE's business plan for direct network investment.

For instance, the UR's assessment included the following:

"For substation and RMU replacements, the main driver for investment is the age and condition of the equipment – a number of RMUs are subject to operational restriction. Recorded numbers of catastrophic failures have risen, due to age and condition related defects."²⁷

"We have also carried out modelling of the asset replacement volumes using NIE Networks asset age profiles and industry accepted asset lives (as stated within Ofgem's CNAIM) for each of the secondary plant asset categories to determine modelled outputs for RP6."²⁸

The UR indicated, with relation to its developmental objectives that at the time of RP6 FD, asset health and load indices were not robust enough to inform asset management decisions. Similarly, NIE had noted Ofgem's work on Asset Health and Load Indices in DPCR5, however it acknowledged that work on developing these was still in its infancy for NIE and at RP6 FD was not sufficiently developed for use as part of an incentive scheme.

The UR explicitly acknowledged Ofgem's work on the Common Methodology for asset health, criticality and monetised risk, alongside the condition based risk management (CBRM), however it provided a rebuttal of these approaches, saying that: *"our focus is outcomes rather than techniques or process. Good asset management is a means to delivering service objectives (including reliability and safety) at least whole life cost to consumers."²⁹*

Delivery accountability arrangements

There exists a scheme, the guaranteed standards of service (GSS), which applied to NIE in its role as an electricity transmission and distribution company, both for RP6 and prior price controls. These GSS outline the steps NIE must take in the event of a complaint or network problems and can specify payments to customers in the event of noncompliance by NIE. At RP6 the UR was in

²⁷ UR (2017) *Annex O Assessment of RP6 Network Investment Direct Allowances Final Determination 30 June 2017*, page 14

²⁸ UR (2017) *Annex O Assessment of RP6 Network Investment Direct Allowances Final Determination 30 June 2017*, page 16

²⁹ UR (2017) *Northern Ireland Electricity Networks Ltd Transmission & Distribution 6th Price Control (RP6) Final determination 30 June 2017*, page 52

the process of updating the application of GSS to NIE. Several adjustments were proposed by the UR, with general acceptance by NIE. Specifically, the new regime increased transparency surrounding payments made under both the new regulations (to be reported annually) and under the existing GSS regime. Reporting was non-retroactive, meaning that only new figures were to be reported from 2017 for the pre-existing GSS regime payments. NIE was also required to provide information on how long it takes to get customers back on supply following a fault or severe weather incident.

The second period of RP6 (2018/19) also saw the inclusion of a reliability incentive mechanism and related reliability incentive payments scheme. Under these approaches, a cap and floor are set for a variety of outcome targets, which are measures of reliability performance that the company should work towards over the period. The cap and floor levels are adjusted as the period progresses in light of updated figures.

In order to protect consumers from the deferral of planned investment the UR applied a deferral mechanism at RP5 which it refers to as the D3 mechanism. This was originally applied to NIE by the CMA following NIE's appeal of the RP5 price control. The goal of the D3 mechanism is to ensure that the company does not receive excessive funding for any deferred investment. The D3 mechanism is only applied to a subset of investment: 'planned network investment'.

The CMA summarised the original intention of the D3 mechanism as follows:³⁰

“Under conventional RAB-based incentive regulation, there is a risk that a regulated company may defer investment projects (and so capex) for which it has received an allowance and in subsequent price control periods seek further allowances for similar projects, or projects designed to have the same effect as those deferred.

Our approach aims to ensure that there should be no double funding of any such deferred network investment. Therefore, in subsequent price controls, we expect that NIE would be required to identify any aspects of its forecast network investment which arise as a result of deferment or abandonment of investment that was included in the calculations we have used to set [this] price control for NIE. These would be netted off its expenditure allowances for the subsequent price control period. This is intended to protect customers from the risk of facing charges for further work which have already been funded.”

Having looked at NIE's delivery over RP5 the UR recognised a need to apply the deferral mechanism when setting allowance for the PR6 period. For RP5 NIE Networks was funded to make permanent improvements to the flood defences of five distribution stations. The UR found that three of the outputs that NIE claimed for the RP5 period sub-stations which were rebuilt as part of the RP5 programme where the new substation equipment was raised to above flood level as part of this rebuild, rather than improving the flood defences. As the UR viewed this as a natural component of rebuilding a substation, it assessed that the investment had been deferred for three of the five funded cases. For RP6, NIE Networks proposed nine additional flood defence projects. Due to the three deferred investment projects from RP5 noted above, the UR determined that three of the new

³⁰ CMA (2014) *Northern Ireland Electricity Limited price determination*, page 6.

units were deferred from RP5 and deducted a pre-funded allowance of £369k from the RP6 allowance.³¹

The RP6 FD modified the D3 mechanism compared to the RP5 period, including a provision called the Direct Network Investment Allowance Substitution, which allowed NIE Networks to substitute higher priority outputs for lower priority outputs which are then deferred to a future price control without incurring a financial penalty. Specifically, this allowed the company to fund additional outputs across the plan by substitution of up to 20% of the investment from defined direct network allowance, up to a total limit of 10% in total. To balance the company's need for flexibility in dealing with changing priorities and emerging pressures whilst protecting the interest of consumers, the direct network investment allowance substitution was only applicable for specific projects that were defined by the UR in its RP6 FD in Annex P.

Cost sharing and adjustments in light of outturn expenditure

NIE Networks is subject to a 50:50 cost sharing mechanism for any under-spend or over-spend relative to ex-ante allowances, applied to both capex and opex.

The UR also included a provision to protect consumers from excessive or inefficient spending, the 'D4' inefficient spend clause. The UR noted Ofgem's inclusion of provisions that allow it to make financial adjustments that have the effect of 'disallowing' the company from recovery of demonstrably inefficient or wasteful costs from charges to consumers. Similarly, the D4 mechanism provides the UR with a comparable ability to adjust NIE Networks' maximum regulated revenues or RAB to protect consumers from exposure (e.g. via customers' share of costs under the cost sharing mechanism) to any costs that the UR has found to be demonstrably inefficient or wasteful. The UR clarified that the following would not be grounds for a disallowance under this provision: costs that are only discovered to be inefficient or wasteful with the benefit of hindsight, and outputs from high-level econometric models that indicate the potential for inefficient or wasteful costs.

Use of uncertainty mechanisms to adjust ex ante allowances

For RP5 the UR implemented the D5 mechanism, which provided flexibility within the price control framework for the adjustment of NIE Networks' maximum revenue and RAB within-period to allow for additional investment projects related to the capacity and capabilities of NIE Networks' transmission system. The grounds for the development of the D5 mechanism were the scale of transmission investment. The UR did however conclude that the D5 provision should not include distribution network expenditure. Allowance through the D5 mechanism is provided on a case-by-case basis. The UR indicated Ofgem's Strategic Wider Works mechanism as an existing example of a similar provision, which allows the network companies to bring forward projects for regulatory approval during the eight-year price control period.

³¹ UR (2017) *Northern Ireland Electricity Networks Ltd Transmission & Distribution 6th Price Control (RP6) Final determination 30 June 2017*, page 39-40

In addition to the D5 mechanism the UR employed two types of uncertainty mechanism at RP6; a volume driver for undereaves service replacement, and re-opener mechanisms for distribution and transmission investment.

Of the distribution investment re-opener mechanisms, three relate to innovative technologies (trials for innovative future investment in the Distribution System and load growth due to the introduction of low carbon technologies) and addressing congestion due to related generation connections.

Similarly, the transmission investment re-openers cover projects targeting transmission system capacity or capability, major transmission system replacement requirements, and trials for innovative future investment in the transmission system.

Office of Rail and Road: Network Rail PR23

Key points

- Our review concerned the Office of Rail and Road PR23 review, setting the expectations for Network Rail for 2024 to 2029.
- Network Rail's business plan was the starting point for the ORR's assessment. The ORR drew on analysis of how proposed renewal and maintenance expenditure for the new control period compared to historic trends, at the regional level, and sought to understand and probe the explanations of Network Rail for this.
- The ORR drew on evidence from a range of approaches. It developed econometric models to produce benchmarking analysis and identify relative efficiencies across Network Rail's regions, drawing on a panel dataset of historical annual data covering the five Network Rail regions. Complementing that analysis, It drew too on its own and third-parties' focused reviews on specific areas of Network Rail's plans (e.g. detailed review of the processes related to asset management and of differences across the regions in this).
- As part of its assessment of the company's plan, ORR reviewed Network Rail's projections on measures related to service failures and to asset sustainability. ORR raised concerns, for example, on the impact of level of planned capital maintenance on some of those measures.
- Performance against a high-level "asset sustainability" outcome is assessed through monitoring of a number of composite metrics/obligations to be reported by Network Rail. Of these, the headline metric is the Composite Sustainability Index (CSI), which captures the change from a baseline (namely from the end of previous control period) of the residual asset life or condition, weighted by replacement value. Supporting measures include the Composite Reliability Index (CRI) which reflects the reliability of assets and their criticality to the service; and a metric on Service Affecting Failures (SAF) which measures the impact on train performance attributed to track, points, signalling and electrification issues.
- There are no financial incentives linked to these metrics: the ORR will investigate matters should concerns arise about the evolution of the metrics.

Background

At the PR23 periodic review, the Office of Rail and Road (ORR) determined what Network Rail (NR) was expected to deliver over control period 7 (CP7), running from April 2024 to the end of March 2029. The determinations covered the outcomes that Network Rail is expected to deliver and the funding required for this.

Ahead of addressing the elements in ORR's approach which touch directly on questions of interest to the study, we think it useful to highlight, by way of background, some aspects related to the wider context and review process:

- The UK government (for England and Wales) and the Scottish Government (for Scotland) are Network Rail's main funders. They specified the broad objectives for the company over the control period through the High Level Output Specification (HLOS) and, in the Statement of

Funds Available (SoFA) set the funding that they will make available for those objectives to be met. The ORR provides expert advice to the two governments on the specification of those documents.

- Once the HLOSs and the SoFAs were set, Network Rail developed its Strategic Business Plan outlining what operational, maintenance and renewal (OMR) activities it could deliver within the funding provided. There was some iteration in the process: Network Rail submitted an initial plan, based on its initial view of funding available and outputs required), prior to the HLOs and SoFAs being finalised.
- The ORR scrutinised Network Rail’s strategic plans and made determinations about the allocation of funding between regions – Eastern, North West & Central, Southern, Wales & Western, in England – and the outputs that Network Rail is expected to deliver.
- Following ORR’s final determinations, which were made at the end of October 2023, Network Rail was due to produce delivery plans for the control period, reflecting those determinations.

As stated above, the PR23 determinations focused on operational, maintenance and renewal activities. It excluded “enhancements”, a term which the ORR uses in a way similar to that used by Ofwat, though improving performance, or growing passenger or freight transport – where this does not involve expanding the capacity of the network – would not be assessed as enhancements.³²

Broad approach to cost assessment for capital maintenance / asset replacement

The ORR organised its cost assessment of Network Rail’s strategic business plan around the following high-level categories: renewals and maintenance; operations; national functions (covering activities that are national, rather than regional, in scope); support; environmental sustainability and digital signalling. We focus here on the approach to cost assessment relating to renewals and maintenance.

Network Rail’s business plan was the starting point for the ORR’s assessment. The ORR drew on analysis of how proposed renewal and maintenance expenditure for the new control period compared to historic trends, at the regional level, and sought to understand and probe the explanations of Network Rail for this.

The ORR drew on evidence from a range of approaches and sources in its assessment. It developed econometric models to produce benchmarking analysis and identify relative efficiencies across Network Rail’s five regions. Such analysis was complemented by a wider evidence base, which included its own and third-parties’ focused reviews on specific areas of Network Rail’s plans.³³ Within this wider-evidence base, we note that the ORR produced a ‘targeted assurance review’ of Network Rail’s approach to maintenance which involved reviewing the practices and processes in

³² ORR’s glossary defines enhancement schemes as “Schemes to change to network outputs, usually involving construction, that improves network capacity or capability (e.g. enabling higher speeds, allowing heavier loads) relative to the level of network outputs funded at the last relevant periodic review. Usually outputs are required at specific times (in contrast to most renewals). Network Rail enhancement projects are listed in its Enhancements Delivery Plan which is updated quarterly.”

³³ ORR (2023) *PR23 final determination: Supporting document – sustainable and efficient costs*,, pages 222-223.

place regarding maintenance across Network Rail's regions with a view to identifying aspects that are inconsistent or that should be improved.³⁴

In respect of econometric modelling, the ORR developed econometric models of Network Rail's maintenance and, of its renewals expenditure. Our understanding is that separate models were estimated for each of the two categories of expenditure. The models were estimated using a panel dataset covering the five regions over a period of 17 years in the case of capital maintenance and 15 years in the case of renewals. Each model sought to capture the main drivers of expenditure, including traffic, track size, possessions³⁵, proportion of electrified track, rainfall and (for renewals) volume of assets renewed. For each of the models, the ORR calculated the efficiency gap for each of the five regions, examining the sensitivity of this to what the ORR describes as different modelling approaches of estimating such a gap. These different approaches reflect different approaches to estimating the modelled expenditure level against which efficiency is measured. It covered, (i) the use of corrected OLS, (ii) the use of an upper-quartile efficiency benchmark, and (iii) two variants of stochastic frontier analysis.

For renewals, the ORR also carried out unit cost analysis. In particular:

- It compared trends in renewals unit cost, by asset class and per work type, over the last two control periods and the one forthcoming (drawing on forecast data for the latter, we imagine). The analysis was done using regional data, allowing ORR to comment on the relative unit costs across regions in the delivery of particular areas of renewal activities.
- For conventional track renewals, it estimated an econometric model of unit cost. The set of variables included as cost drivers seem to capture the same factors as were included in the aggregate" cost models described earlier, namely traffic, track size, possessions, proportion of electrified track, rainfall and volume of assets renewed. ORR estimated the models drawing on a panel dataset with annual data from 2013/14 to 2028/29 from each of the five regions. The ORR explains that due to inconsistencies in the data it was only able to conduct such analysis on conventional track renewals unit cost.

The ORR drew on the findings from across the set of analysis to come to a view on the level of efficiencies that Network Rail had assumed in developing its strategic plans for the new control period.

Consideration given to asset health in setting ex ante allowances

Alongside safety, performance and efficiency, the ORR had identified asset sustainability as one of its four overarching objectives for the PR23 review. In line with this, ORR's review of Network Rail's strategic business plan considered matters relating to asset health. We highlight the following:

- The ORR considered the implications on asset sustainability of Network Rail's proposed plans. That assessment drew on the information provided in the plans themselves – which included

³⁴ ORR (2022) *Network Rail's approach to maintenance: Targeted Assurance Review*.

³⁵ Possessions refer to sections of track which are required for maintenance and on which, during such periods, trains cannot run.

forecasts of asset failures and of asset condition and performance – challenge sessions with the operator and on information gathered through ORR’s regular monitoring of Network Rail.

- Drawing on that assessment, the ORR had expressed concerns at draft determinations on the sustainability of certain assets and proposed that Network Rail revise its plan to increase on core asset renewals. Network Rail reflected those proposals in the subsequent version of the business plan considered for final determinations.
- Given the constraint set by the SoFA, ORR recognised that there would not be further funding for the additional renewal expenditure and, in that light, put forward options for Network Rail to reprioritise expenditure, identifying areas or projects that it might be able to cut-back on over CP7.
- The ORR assessment includes consideration about the interaction between renewals and maintenance expenditure. At draft determinations, it noted that Network Rail would need to consider increasing maintenance expenditure to keep assets operational due to the reduced core renewal expenditure it was proposing. It also expressed concerns then about the operator’s strategy of replacing proactive engineering solutions with operational controls. At final determinations, ORR considered that the revised plan that Network Rail developed after draft determinations addressed those concerns to some extent, namely by the increase in core renewals and by assuring better alignment between renewals and maintenance.
- In the context of the above considerations, the ORR reported Network Rail’s estimates of the additional maintenance required by the end of the price control due to delayed renewals and the ageing asset base. The figures are set out in the operator’s Strategic Business Plan (version of May 2023). The details of how they were derived are not given beyond the comment that they are derived from “experience and judgement, supported by modelling, analysis and case studies, to estimate the change in maintenance demand as a result of more assets becoming at or beyond the assessed end of asset life (which will be contributed to by a lower level of renewal activity in CP7)”.³⁶ The table below reports those estimates.

Table 3 Estimated increase in maintenance activity as a result of delayed renewals and an ageing asset base³⁷

Asset type	Increase in maintenance required by end of Control Period 7
Track	5%
Signalling and level crossing	10%
Telecoms	10%

³⁶ Network Rail (May 2023) *England and Wales Strategic Business Plan Control Period 7*, page 114.

³⁷ ORR (2023) *PR23 final determination: Supporting document –sustainable and efficient costs*, page 62.

Asset type	Increase in maintenance required by end of Control Period 7
Electrification	5%
Off-track	5%
Structures	0%
Operational property	10%

We stated earlier that the ORR considered the forecasts of asset failures and of asset condition and performance in its assessment of Network Rail’s plans. We unpack this with a view in particular to introduce three metrics which the ORR considered:

- Service affecting failures (SAFs).** The ORR reviewed Network Rail’s projections on the number of SAFs, broken down by region. SAFs measures the impact on train performance that are attributable to track, points, signalling and electrification issues. ORR noted that Network Rail identified the lower renewal expenditure over CP7 as a driver of the higher forecast SAFs. The ORR considered that the timing of such impacts is, however, complex so that the nature and impact of the faults or failure of assets at the end of their lives is uncertain. The ORR also commented that there might be a gap between the assumed end of asset life and the point of asset failure . For these reasons, the ORR felt that all Network Rail regions were insufficiently challenging in accepting the projected increase in SAFs, and noted that Network Rail was continuing to work to strengthen evidence and analysis in this area, which would deliver revised forecasts ahead of it submitting the CP7 delivery plan.
- Composite reliability index (CRI).** The CRI is an indicative measure of reliability of the overall network which takes account of the different asset types and their criticality. It is calculated by weighting the incidents of a certain set of asset failures by their impact on train services, based on the payments related to the compensation to train for unplanned disruption cause by Network Work and other train operators (referred to as Schedule 8 payments). As with its review of SAFs, the ORR’s final determinations reports on Network Rail’s forecast of the CRI and comments that it finds it insufficiently challenging.
- Composite sustainability index (CSI).** The CSI is intended to measure the relative change in the residual asset life or condition, using the value at the end of a previous control period as the baseline level for the subsequent period. For CP7 the ORR defined the measure as the percentage improvement of asset sustainability compared to the end of control period 4. Depending on the type of asset, the sustainability of the asset is measured either by its remaining life or by its condition score and is weighted by its replacement value.³⁸ The ORR comments that Network Rail’s forecast is for the CSI to decline over CP7 and in the longer

³⁸ ORR (2023) PR23 final determination: Supporting document –outcomes, page 89.

period, and agrees with Network Rail's assessment that this is justified due to the prioritisation given to safety and train-performance over longer-term sustainability. ORR accepts the proposed (downward) trajectory CSI put forward by Network Rail.

Our understanding then is that the ORR drew on information on trends in asset health and failures to inform its view on the appropriateness of the volume of maintenance and renewal activity that Network Rail had put forward in its business plan. At final determinations, the ORR considered that Network Rail's regions were not being stretching enough in the forecast level of service affecting failures and of the composite reliability index, and suggested that the company review these aspects in advance of submitting its delivery plan for the control period.

Delivery accountability arrangements

The ORR defined the terms of an "outcomes framework" for CP7 which set out the expectations on what Network Rail needs to deliver over the control period. There are six high-level "outcome areas": passenger train performance; freight train performance; asset sustainability; efficiency and financial performance; environmental sustainability; and freight growth. For each of those outcome areas, the ORR identified a "success measure" – the key metric to capture Network Rail's performance – and a set of supporting measures.

With regard to asset sustainability, the success measure used by the ORR is the composite sustainability index (CSI), introduced above. The set of supporting measures for asset substitutability cover:

- Composite reliability index (CRI), which we described earlier.
- Effective volumes: this is a weighted aggregation of renewal volumes, where the weights distinguish between activity types and their impact on asset lives. ORR comments that effective volumes of asset type cannot be compared to another due to different units and scales of measurements and so we infer that such effective volumes would be reported by asset type.
- Service Affecting Failures (SAFs), which we also described earlier.
- Delivery in a number of identified high priority areas. These priority areas included lineside vegetation, compliance in examination of structures, of earthworks, of buildings and of drainage. It also included performance on planned versus actual volume hours of maintenance; the ORR describes this last measure as involving a comparison of "year-to-date planned modelled hours (based on base plan volumes * Activity Based Planning (ABP) norm times) to year-to-date modelled hours (based on actual volumes * ABP norm times)".
- Asset data quality. The ORR set timebound obligations for Network Rail to meet asset data improvement milestones and data quality standards.

The ORR developed a baseline trajectory for the CSI success measure, drawing on the forecasts in Network Rail's strategic business plan and on its own analysis and independent reviews.

Our understanding is that there are no financial incentives linked directly to any of the success or supporting measures: there are no ODI-like arrangements nor PCD-like mechanisms. The ORR monitors and reports the "success measures" in each outcome area against the baseline

trajectories defined by it, and monitors and reports the supporting measures. It may investigate matters should it have concerns about the evolution of any such measure over the control period.

Cost sharing and adjustments in light of outturn expenditure

There is no cost-sharing mechanism in place.

Our understanding is that, in broad terms, the price control acts like a budget for Network Rail, with a distinction made between capital expenditure and non-capital expenditure, and each budget subject to different controls and flexibility. With regard to capital expenditure, following the ORR determinations, the UK government agreed to a budget profile for the length of the price control. Network Rail is able to request to defer or bring forward some of the budget for capital expenditure; this is subject to Treasury approval at Budget.³⁹

Following year-end, Network Rail must inform the Department for Transport of any year-end underspends and reasons for this. The Treasury is expected to approve re-approve of up to 2% of the capital expenditure budget year-end underspends deferred to later years.

Budgeted amounts from capital expenditure cannot be transferred to resource (i.e. non-capital) expenditure.

The framework does envisage the possibility that Network Rail make rebate payments to the government. This would be done via rebates to the franchised passenger operators who, via the terms of their franchise agreements, would pass these on to the government. The possibility of rebates would arise in circumstances where Network Rail considers it does not need the rebate income to discharge its obligations. The ORR is clear in stating these this should only be in exceptional circumstances and where they do not create risks to the financial sustainability of the operator.

Use of uncertainty mechanisms to adjust ex ante allowances

The regulatory framework includes re-opener provisions that could lead to a change in the terms of the determinations. In particular, the track access contracts – contracts between Network Rail and the operators – include provisions for re-openers in two scenarios:

- A material change in the circumstances of Network Rail or in relevant financial markets; and
- If expenditure in Scotland is forecast to be more than 15% higher than the ORR determination over a forward-looking three-year period. This provision applies to Scotland only.⁴⁰

³⁹ ORR (2023) *PR23 final determination: Policy position – financial framework*, page 30.

⁴⁰ ORR (2023) *PR23 final determination: Policy position – financial framework*, page 23..

Civil Aviation Authority: Heathrow Airport

Key points

- The Civil Aviation Authority (CAA) set price controls for Heathrow Airport Limited (HAL) for the five-year period running from January 2022 to December 2026 (H7).
- The CAA set separate allowances for opex and for capex.
- Capital expenditure projects follow a governance process that takes them through a series of gateways, where the needs case, the scope, the budget etc are successively reviewed, refined and agreed on. HAL and airlines are central to that process and must agree for a project to progress.
- CAA's assessment of capital expenditure plans at the review was structured along the lines of projects to be submitted to, or already within, that governance process. One of those projects concerned asset replacement. For each project, CAA reviewed (i) the needs case for it, and (ii) the efficiency of the costs put forward.
- CAA drew on analysis from external experts on this including to develop some cost benchmarking at level of granular activities.
- Considerations on asset health might be a factor in review of 'needs case' for a project; we saw no explicit reference to asset health metrics in description of cost assessment modelling itself.
- As part of the capex governance process, delivery obligations are agreed for each project, setting out the expected outputs, quality requirements and timing for the project. A proportion of baseline capex will be associated with each obligation and a set of indicators defined to determine whether an obligation has been met.
- Within the five-year control period, there are two two-month windows for reopening the capex allowance.

Broad approach to cost assessment for capital maintenance / asset replacement

The CAA set separate allowances for opex and for capex. The distinction between the two does not arise just from a cost assessment point of view; different regulatory arrangements apply to each of those allowance pots over the regulatory period. In particular, there is a governance process in which airlines – as the customers of HAL – are involved. Airlines scrutinise capex schemes proposed by HAL and must agree to their scope and budget before these are carried out.

The assessment of HAL's proposed capital maintenance over the regulatory period is subsumed within CAA's assessment of the company's capital expenditure more broadly. In turn, CAA's assessment of HAL's capital expenditure, and therefore encompassing capital maintenance schemes, was done on a project-by-project basis.

The CAA's capex cost assessment at H7 distinguished between two categories of projects: "Development" and "Core" projects. That categorisation reflects the stage along the capital expenditure governance process at which a project is. The capex governance process involves HAL and airlines, and requires capital expenditure schemes to go through a set of gateways, where

the needs case for the scheme, its scope, costing and deliverability is scrutinised and agreed on. At one of those gateways, Gateway 3, the precise scope, the delivery obligations and the budget for the scheme has to be jointly agreed by HAL and by the airlines. At H7, “Core” projects were those that had already been through Gateway 3 at the time of the CAA’s assessment for H7, whilst “Development” projects were ones that had not yet reached that stage of the governance process.

At H7, and in respect of “core” projects that had already progressed through Gateway 3, the CAA was not bound by the budget already agreed at that stage of the governance process. Differences between such agreed budgets and the view taken by the CAA at the time of setting the control at the price review, will lead to a change in the allowances for the period.

In terms of the cost assessment itself, the regulator, and its external adviser, reviewed the information provided by HAL on each proposed project and considered:

- the needs case for the projects; and
- the efficiency of the costs put forward for their completion.

The CAA commented that the quality and granularity of the information provided by HAL varied across the set of projects and that this influenced the type of analysis the CAA and its advisers could draw on for the purpose of assessing the efficiency of the costs being put forward. The work involved engaging with HAL to clarify aspects of projects, reviewing HAL’s approach to developing their costing and checking the robustness of these, including by benchmarking selected areas where this was considered feasible.

In their review of HAL’s capital expenditure plans, CAA’s consultants, Arcadis, carried out, bottom-up analysis to check the cost estimates put forward by the operator as well as top-down analysis. The review, organised in line with the set of programmes put forward in HAL’s plans, the consultants’ methodology included:⁴¹

- reviewing HAL’s plans on “quantities”, i.e. on the scope of the project;
- reviewing unit costs of specific activities (e.g. replacement of lifts) drawing on internal and external benchmarks, comparing these with ones put forward by HAL (where reported); and
- reviewing the percentage mark-ups applied for items such as risk, prelims, overheads, and checking against industry benchmarks.

As commented earlier, the level of detail of the analysis that the CAA’s consultants delivered varied across schemes, reflecting in part the quality of the data provided by HAL. The summary set of slides produced by Arcadis and published by the CAA provide limited technical details on the analysis done.

⁴¹ See for example Arcadis (2022) *HAL RBP Update 2 – Capex plan review*.

Falling within the top-down categorisation of approaches to their review, the consultants also reviewed trends over time in HAL's expenditure on the relevant high-level relevant expenditure, and comparison of those trends with ones at other airports.

As an output of their review, CAA's consultants put forward for each of HAL's projects reviewed their recommended minimum and maximum costs.

Consideration given to asset health in setting ex ante allowances

Asset health considerations will have informed, it seems to us, the strength of the needs case for a programme put forward by HAL.

In line with this, we note that in their review of CAA's programme labelled "Asset management and compliance" – the largest of the programmes within HAL's plan – Arcadis considered, not surprisingly given the scope of the programme, evidence on the condition of assets. .

Delivery accountability arrangements

At H7, the CAA implemented an ex ante capex incentive framework. One element of that framework is the requirement that, for each project, "delivery obligations" (DOs) be agreed with airlines at Gateway 3 within the capex governance process. In particular:⁴²

- the DOs should include the expected outputs of the project, the quality requirements and the timing of when these are to be delivered;
- each DO should have a weighting to determine what proportion of baseline capex is associated with performance against each. SMART indicators should be established to determine whether or not each DO has been met, and the level of adjustment to baseline capex associated with non-delivery.

Cost sharing and adjustments in light of outturn expenditure

There is no explicit cost sharing in respect of operating expenditure.

There are cost sharing arrangements in place which apply at the level of individual projects, i.e. those assessed within the setting of the capex allowance. Specifically, there is a 25% sharing factor applied to under- or over-spend against the budget agreed at Gateway 3.

There is a "traffic risk sharing" mechanism such that there is some sharing of the difference between the out-turn allowed revenues and forecast allowed revenue in a given year.⁴³

Use of uncertainty mechanisms to adjust ex ante allowances

There is scope for HAL's allowances to be adjusted in the course of the control period.

⁴² CAA (2023) *Economic regulation of Heathrow Airport: H7 Final decisions – Section 2 Building Blocks*, CAP2524C, page 53.

⁴³ CAA (2023) *Economic regulation of Heathrow Airport: H7 Final decision Section 1: Regulatory framework*, CAP2524B, pages 28-30.

In respect of opex allowances, the CAA's decision makes it clear that there is scope for adjustments to protect HAL against risks of unanticipated related to security. The example given in the regulator's decision is that of costs associated with unforeseen tightening of security arrangements.⁴⁴ CAA's proposed route on this is to allow for the pass through of such increased costs.

In respect of adjustments to the capex allowances:

- there is a cap on the overall capex envelope, equal to the capex allowance determined by CAA for the H7 price control, plus 5%; and
- HAL has two two-month windows when it can apply for that cap to be increased. Over the H7 period, from 2022 to 2026, the windows are over February and March 2024, and over February and March 2025. The CAA adds that in exceptional circumstances HAL may seek CAA's consent to apply for a reopener outside those windows.

⁴⁴ CAA (2023) *Economic regulation of Heathrow Airport: H7 Final Decisions – Section 2 Building Blocks CAP2524C*, page 19.